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ASSIGNMENT BOOKLET

SCN2231 Biology 30

Module 6 Assignment

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Biology 30

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we engage

Mendelian Genetics:

The Transmission of Traits to the Next Generation

Module 6

Assignment Booklet



Calgary Board of Education

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FOR TEACHER'S USE ONLY

Summary

	Total Possible Marks	Your Mark
Lesson 2 Assignment	20	
Lesson 3 Assignment	17	
Lesson 4 Assignment	33	
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Lesson 7 Assignment	18	
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Teacher's Comments

Biology 30 Learn EveryWare
Module 6: Mendelian Genetics—The Transmission of Traits to the Next Generation
Assignment Booklet
ISBN 978-0-7741-3194-0

Cover Art: © 2008 Jupiterimages Corporation

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Teachers	✓
Administrators	
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General Public	
Other	



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MODULE 6: LESSON 2 ASSIGNMENT

This Module 6: Lesson 2 Assignment is worth 20 marks. The value of each assignment and each question is stated in the left margin.

Lesson 2 Assignment: Mendel's Laws and Monohybrid Crosses

(20 marks) Lab: Mouse Genetics (One Trait)

Observations

- (2 marks) 1. In the gizmo on Mouse Genetics, click on the "Copy Screen" button near the bottom right. You will need to attach the resulting image (Heterozygous Cross) to the Lesson 2 Assignment. Therefore, you will need to print a copy of your screen capture.
- (2 marks) 2. Continue to work through the exploration guide. After you have completed step 3 (the cross between a pure-breeding white mouse and a heterozygous mouse), take a copy of your screen (pure recessive and heterozygous crosses) and print your screen capture. Then attach the screen capture to the Lesson 2 Assignment. Make sure it displays statistics.

Calculations

- (1 mark) 3. Based on the heterozygous cross above, what was the expected ratio of black : white offspring?
-
- (2 marks) 4. What actual numbers did you discover from 100 crosses? How do these numbers compare to the expected ratio?
-
-
-
- (1 mark) 5. Based on the pure-breeding white mouse and heterozygous mouse crosses you conducted above, what was the expected ratio of black : white offspring?
-

- (2 marks) 6. What actual numbers did you discover from 100 crosses? How do these numbers compare to the expected ratio?

Conclusions

Answer the following questions about the simulation you carried out.

- (1 mark) 7. What combinations of parents give rise to only white-fur offspring?

- (1 mark) 8. What combinations of parents give rise to only black-fur offspring?

- (1 mark) 9. Are there any combinations that give rise to both black-fur and white-fur offspring?

- (2 marks) 10. Complete the following Punnett square.

		Parent 1	
		<i>F</i>	<i>f</i>
Parent 2	<i>F</i>		
	<i>f</i>		

- (1 mark) 11. When a homozygous, or pure-breeding, white mouse is crossed with a heterozygous black mouse, what is the expected black: white ratio in the offspring?

- (1 mark) 12. When a homozygous, or pure-breeding, white mouse is crossed with a heterozygous black mouse, what is the expected black: white ratio in the offspring?

- (1 mark) 13. The parents in both of the crosses look the same. Why are the results different?
-
- (2 marks) 14. How can a pure white mouse help determine the genotype of a black mouse? (Hint: We cannot see genotype but we can see differences in the phenotype of their offspring).
-
-
-

MODULE 6: LESSON 3 ASSIGNMENT

This Module 6: Lesson 3 Assignment is worth 17 marks. The value of each assignment and each question is stated in the left margin.

(17 marks) **Lesson 3 Assignment—Multiple Alleles and Incomplete Dominance Crosses**

Lab

Observations

- (5 marks) 1. In the gizmo on Chicken Genetics, click on the “Copy Screen” button near the bottom right and print the resulting image (heterozygous cross). Then attach the screen capture to the Lesson 3 Assignment.

Calculations

- (1 mark) 2. Based on the heterozygous cross above, what was the expected ratio of red : red/ white : white offspring?
-
- (2 marks) 3. What actual numbers did you discover from your 100 crosses? How do these numbers compare to the expected ratio?
-
-
-

- (2 marks) 4. If possible, compare your results with other students. In the group, what were the average percentages of red, white, and red/white chickens? Are the total group results closer to the predicted percentages? Why do you think this is the case? (Note: If you are unable to combine your results with the results of many other students, you can create a larger sample size by breeding 1000 or 2000 chicken offspring yourself.)

Conclusions

Answer the following questions about the simulation you carried out.

- (2 marks) 5. Complete the following Punnett square

		Parent 1	
		F^R	F^W
Parent 2	F^R		
	F^W		

- (2 marks) 6. When a homozygous chicken (white or red) is bred to a heterozygous chicken (red/ white), approximately what percentage of the offspring will be homozygous? What percentage will be heterozygous?

- (3 marks) 7. Are there any combinations of parent-chicken genotypes that produce red offspring and white offspring, but no red/white offspring? Explain why or why not.

MODULE 6: LESSON 4 ASSIGNMENT

This Module 6: Lesson 4 Assignment is worth 33 marks. The value of each assignment and each question is stated in the left margin.

(33 marks) Lesson 4 Assignment—Dihybrid Crosses

Lab

Observations

- (2 marks) 1. In the gizmo on Mouse Genetics, after completing Step 4, click on the “Copy Screen” button near the bottom right and print the resulting image (Heterozygous Cross). You will need to attach the screen capture to the Lesson 4 Assignment. The screenshot should show two black-fur, black-eyed parents, and offspring of various phenotypes including white fur, red eye. You should also have “statistics” turned on, and you should have clicked on the “breed” button a few times.
- (2 marks) 2. Independent Assortment
- Continue to work through the Exploration Guide. After you have completed Step 1 in this section (the cross between a black-fur, black-eyed mouse and a white-fur, black-eyed mouse) and have bred 100 offspring. Take a copy of the screen ($FfEE$ crossed with $FfEE$) and print it. Then attach the screen capture to the Lesson 4 Assignment.
- (2 marks) 3. Work through Step 3. Be sure to follow all of the steps so that you have a $FfEe \times FfEe$ for the final breeding. Breed these mice 160 times as asked, and take a copy of the screen ($FfEe \times FfEe$) and print it. Attach the screen capture to the Lesson 4 Assignment.

Calculations

- (1 mark) 4. Based on the *FfEE* crossed with *FfEE* shown above, what was the expected ratio of black : white-fur offspring?

- (2 marks) 5. What actual numbers did you discover from 100 crosses? How do these numbers compare to the expected ratio?

- (1 mark) 6. Based on the *FFEe* crossed with *FFEe* shown above, what was the expected ratio of black : red-eyed offspring?

- (2 marks) 7. What actual numbers did you discover from 100 crosses? How do these numbers compare to the expected ratio?

8. From the third cross under Independent Assortment:

- (1 mark) a. What was the theoretical probability of inheriting black fur (ignoring eye colour)?

- (1 marks) b. What was the theoretical probability of inheriting black eyes (ignoring fur colour)?

- (1 mark) c. Assuming the inheritance of each trait is independent, what is the probability of inheriting black fur and black eyes? (Hint: For independent events, you should multiply the probabilities.)

- (1 mark)

d. Using the same reasoning, what is the probability of inheriting white fur and red eyes?
- (1 mark)

e. What is the probability of inheriting black fur and red eyes?
- (4 marks)

f. What is the probability of inheriting white fur and black eyes?

Conclusions

Answer the following questions about the simulation you carried out.

- (4 marks)

9. Complete the following Punnett Square

		Parent 1 (<i>FfEe</i>)			
		<i>FE</i>	<i>Fe</i>	<i>fE</i>	<i>fe</i>
Parent 2 (<i>FfEe</i>)	<i>FE</i>				
	<i>Fe</i>				
	<i>fE</i>				
	<i>fe</i>				

- (1 mark)

10. Of the 16 offspring represented in the Punnett Square, how many have black fur and black eyes? (Hint: Look for mice with at least one *F* and at least one *E* allele.)
- (1 mark)

11. How many have black fur and red eyes? How many have white fur and black eyes?
- (1 mark)

12. How many have white fur and red eyes?
- (1 mark)

13. How do these probabilities compare to what you calculated above? Do they coincide?

- a. $FfEe$ and $ffee$

- b. $FfEE$ and $Ffee$

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There is no text or other markings on the paper.

MODULE 6: LESSON 5 ASSIGNMENT

This Module 6: Lesson 5 Assignment is worth 30 marks. The value of each assignment and each question is stated in the left margin.

(30 marks)

Calculating Probability

(7 marks)

Observations

1. Complete the following tables as you toss your coin.
- a. Coin tossed in cup—10 times

Heads	Tails

- b. Coin tossed in cup—50 times

Heads	Tails

- c. Two coins tossed in cup—48 times

	Trials (Sets of 8)						Total
2 Heads							
1 Head 1 Tail							
2 Tails							

- d.

Trial 1	
Trial 2	

Analysis and Interpretation**2. Tossing one coin****(1 mark)**

- a. When tossing one coin, what is the chance that you will get a head on any one toss?

(1 mark)

- b. What is the chance you will get a tail?

(1 mark)

3. Theoretically, when you toss a coin 10 times, how many heads and how many tails should you get? Check your results to see how close you were to this expected ratio.

(1 mark)

4. Was the ratio of heads to tails closer to 1 : 1 when you tossed the coin 50 times than when you only tossed the coin 10 times?

(1 mark)

5. What generalization can be made about the number of times an event must occur to get the actual results near the predicted values, or exactly as predicted?

6. Theoretically, if you toss two coins together 48 times, how many times should you get the following results?

(1 mark)

- a. Two heads

(1 mark)

- b. A head and a tail

(1 mark)

- c. Two tails

- (1 marks) 7. Compare your actual results from Table C to the predicted results made in question 5. What could you do to get the actual results even closer to the theoretical numbers?

8. In the last part of the Procedure you are verifying the product rule.

- (1 mark) a. What does this rule state?

- (1 mark) b. According to this rule, how often should three consecutive heads come up on the average?

Conclusions

- (1 mark) 9. Do Mendel's F₂ results conform to the probabilities and ratios previously summarized in this lab?

Now apply the concept of probability to a dihybrid cross using widow's peak hairline and free earlobes as the inherited traits. Widow's peak is dominant to a straight hairline, and free earlobes are dominant to attached earlobes. Use *W* for widow's peak and *w* for straight hairline, and *E* for free earlobes and *e* for attached earlobes.

- (1 mark) 10. What is the general rule for determining the probability of inheriting two specific traits at the same time?

- (2 marks) 11. What are the chances that two individuals heterozygous for widow's peak and free earlobes, *EeWw*, will have a girl with a straight hairline and attached earlobes (do not forget that gender outcome is also a probability)?

12. In humans, Rh^+ blood is dominant to Rh^- . A man and woman are both Rh^+ , but their first child is Rh^- .

(1 mark)

- a. What is the chance that their next child will be Rh^- ?
-

(2 marks)

- b. Calculate the probability that the next child will be an Rh^+ girl.
-

13. In guinea pigs, black coat colour is dominant to white.

(1 mark)

- a. What is the probability that a heterozygous black guinea pig crossed with a white one will produce a white offspring?
-

(1 mark)

- b. What is the predicted ratio of black to white offspring from this cross?
-

Using the rule of independent events and the product rule, consider the probabilities for the following dihybrid cross.

14. Some dogs bark while others are silent when trailing prey. The barking characteristic is due to a dominant gene (B). Erect ears (E) are dominant to drooping ears (e).

(1 mark)

- a. If you crossed a dog heterozygous for both traits with a droopy-eared, silent trailer, what are the chances that one of their offspring will be dominant for both traits (erect-eared, barking trailer)?
-

(1 mark)

- b. What are the chances of these two dogs producing a droopy-eared, silent trailer?
-

(1 mark)

- c. If two dogs heterozygous for both traits were crossed, what would be the chance of them producing a droopy-eared, silent trailer?
-

MODULE 6: LESSON 6 ASSIGNMENT

This Module 6: Lesson 6 Assignment is worth 23 marks. The value of each assignment and each question is stated in the left margin.

(23 marks) **Lesson 6 Assignment—Chromosomal Theory and Sex-Linked Inheritance**

Observations

Drosophila Mating

Use the following tables to record the data you obtained from conducting the two different *P* crosses using the vials on the shelf.

Cross 1 (3 marks)

	Phenotype of Male Parent	Phenotype of Female Parent	# of Red-eyed Male Offspring	# of White-eyed Male Offspring	# of Red-eyed Female Offspring	# of White-eyed Female Offspring
P Gen						
F1 Gen						
F1 Used in Cross						
F2 Gen						

Cross 2 (3 marks)

	Phenotype of Male Parent	Phenotype of Female Parent	# of Red-eyed Male Offspring	# of White-eyed Male Offspring	# of Red-eyed Female Offspring	# of White-eyed Female Offspring
P Gen						
F1 Gen						
F1 Used in Cross						
F2 Gen						

Punnett Square Notebook

Make sure you have conducted several crosses in the notebook on the screen. This drag and drop practice is easy to do, and will help you understand how to analyze X-Linked crosses.

Conclusions

Answer the following questions about the simulation you just carried out (these are the Journal questions from the simulation).

(2 marks)

1. Describe the phenotypes and genotypes of the parents that you chose on the Punnett squares screen.

(3 marks)

2. Describe the offspring phenotype and genotype ratios that resulted from crossing the parents that you chose on the Punnett squares screen. Using these ratios, what percentage of offspring is white-eyed? What percentage of offspring is red-eyed?

- (2 marks) 3. Did you mate *Drosophila* in the laboratory first, or did you perform genetic crosses using Punnett squares first? Why? Compare and contrast the data you collected from the Punnett squares to the data you collected from the *Drosophila* mating.

- (2 marks) 4. In a mating between a red-eyed male fruit fly and a red-eyed heterozygous female, what percentage of the female offspring is expected to be carriers? How did you determine the percentage?

- (2 marks) 5. In a mating between a red-eyed male fruit fly and a white-eyed female fruit fly, what percentage of the male offspring will have white eyes? Describe how you determined the percentage.

- (2 marks) 6. Hemophilia, a blood disorder in humans, results from a sex-linked recessive allele. Suppose the daughter of a mother without the allele and a father with the allele marries a man with hemophilia. What is the probability that the daughter's children will develop the disease? Describe how you determined the probability.

- (2 marks) 7. Colour-blindness results from a sex-linked recessive allele. Determine the genotypes of the offspring that would result from a cross between a colour-blind male and a homozygous female who has normal vision. Describe how you determined the genotypes of the offspring.

- (2 marks) 8. Explain why X-linked traits appear more often in males than in females.

MODULE 6: LESSON 7 ASSIGNMENT

This Module 6: Lesson 7 Assignment is worth 18 marks. The value of each assignment and each question is stated in the left margin.

(18 marks) Lesson 7 Assignment: Genes and the Environment

Effect of Temperature on Gender

Observations

1. During this lab you created two larger collections of data: one for the effect of temperature on chicken hatchlings, and one for the effect of temperature on gecko hatchlings. You followed the instructions given in the guide under heading 2 to create the table and graph for the chicken experiments.

- (2 marks)** a. Copy and print a screenshot of the Table of Evidence for the Chicken Hatchlings, and then attach it to the Lesson 7 Assignment.

- (2 marks)** b. Copy and print a screenshot of the Graph for the Chicken Hatchlings, and then attach it to the Lesson 7 Assignment.

2. In a similar fashion, follow the instructions under heading 3 to create the table and graph for the gecko experiments. Now paste both of these below.

- (2 marks)** a. Copy and print a screenshot of the Table of Evidence for the Gecko Hatchlings, and then attach it to the Lesson 7 Assignment.

- (2 marks)** b. Copy and print a screenshot of the Graph for the Gecko Hatchlings, and then attach it to the Lesson 7 Assignment.

Conclusions

Answer the following questions about the simulation you have just carried out.

Using your data for the chicken experiments, answer the following questions:

(2 marks)

3. Using the graph you generated, can you see any trend relating the incubator's temperature to the gender of the birds? Describe any trend you observe.

(3 marks)

4. If the temperature was set to 28°C, could you predict the exact number of male birds that would hatch from 100 eggs? Could you make an approximate estimate? Explain, and give numerical values where appropriate.

Using your data for the gecko experiments, answer the following questions.

(2 marks)

5. Using the graph you generated, can you see any trend relating the incubator's temperature to the gender of the geckos? Describe any trend you observe.

- (3 marks) 6. If the temperature was set to 26°C, could you predict the exact number of female geckos that would hatch? Could you make an approximate estimate? Explain, and give numerical values where appropriate.

MODULE 6: LESSON 8 ASSIGNMENT

This Module 6: Lesson 8 Assignment is worth 15 marks. The value of each assignment and each question is stated in the left margin.

(15 marks) **Module 6: Lesson 8 Assignment**

- (15 marks) 1. Complete question 19, parts a to c on page 621 of your textbook. The mark breakdown is as follows:
- a. **1 mark**
 - b. **4 marks**
 - c. **10 marks.** (Do not go into detail on procedure. Concentrate on identifying what kinds of crosses the farmer can conduct to determine if disease and height tend to move together. Include a hypothesis and identify your controls and how you will interpret possible outcomes.)

MODULE 6: LESSON 9 ASSIGNMENT

This Module 6: Lesson 9 Assignment is worth 22 marks. The value of each assignment and each question is stated in the left margin.

(22 marks) **Lesson 9 Assignment—Crossing Over Frequencies and Gene Mapping**

(10 marks) **Lab: Mapping Chromosomes**

Constructing gene maps allows researchers to locate and study genes and their inheritance. You will practise creating your own map by completing Part A of “Thought Lab 17.1” on page 602 of your textbook.

Follow the instructions given in the text for Part A. Save your responses to each of the questions and create a simple graphic indicating the distance in map units between the genes studied. Attach your answers to the Lesson 9 Assignment. The mark breakdown is indicated.

Procedure

Chromosome map **(6 marks)**. Make sure your map is correct with respect to relative distance. Use a key such as 1 cm = 1 map unit.

Analysis

1. **(2 marks)**
2. **(2 marks)**

(12 marks) **Discussion**

Research the issue of private industry in genetic research and/or testing. Take a position on whether or not private industry should be allowed or encouraged to participate in the advancement of the field of personal health. Communicate your position to your peers and teacher on a class Discussion Board, or in whatever manner your teacher sets up for you. Engage your classmates in the defense of your position, and challenge others to defend their positions. Revise your response after your discussion with your classmates and attach it to the Lesson 9 Assignment. If it is not possible to attach your answer, submit it in another way when instructed to do so later in this lesson. You will be graded according to the following rubric.

DISCUSSION RUBRIC

Learning outcome	Exemplary (all points) 3 marks	Accomplished (most of the points) 2 marks	Developing (minimal points) 1 mark	Not yet started 0 marks
Communicates Ideas	The learner communicates ideas eloquently and thoroughly. Specific examples from the activity and/or resource are provided to support his or her ideas and opinions. The learner is able to provide additional resources or applications for the discussion topic.	The learner communicates ideas, opinions, and conclusions clearly and completely. Specific examples from the activity and/or /resource are provided to support his or her ideas and opinions.	The learner communicates ideas well, but fails to provide evidence to support his or her ideas, opinions, and conclusions.	The learner fails to communicate his or her ideas.
Understanding of the Activity	The learner's contribution to the Discussion Board demonstrates a thorough understanding of the concept being presented, be it stem cell research, reproductive technology, drug use, or the environment.	The learner's contribution to the Discussion Board demonstrates an understanding of the concept being presented.	The learner's contribution to the Discussion Board demonstrates a developing understanding of the concept being presented, but further explanation and exploration is needed.	The learner's contribution does not demonstrate an understanding of the task.
Peer Review	The learner provides meaningful feedback on others' ideas. Comments include how the idea could be enhanced and how the idea might be applied to a different content area or personal experience. The learner's response encourages other group members to share ideas.	The learner provides meaningful feedback on others' ideas. Comments include personal reactions and/or experience. The learner's response encourages other group members to share ideas.	The learner provides comments on others' ideas, but not specific feedback. The learner's response discourages other group members to share ideas.	The learner does not comment on other posts.
Mechanics of Messages	The learner's response has an	The learner's response has an	The learner's response lacks	The learner's response cannot be

	obvious logical and/or sequential organization. The message has been edited for grammar and spelling. The student contributes to the Discussion Board regularly and in a timely manner.	obvious logical and/or sequential organization. The message has been edited for grammar and spelling.	organization. The message has not been edited for grammar and spelling.	followed or understood.
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MODULE 6: LESSON 10 ASSIGNMENT

This Module 6: Lesson 10 Assignment is worth 18 marks. The value of each assignment and each question is stated in the left margin.

(18 marks)

Lesson 10—Plant, Animal, and Human Genetics

Create a Real Pedigree

Complete “Thought Lab 17.2” on page 615 of your textbook. Save your answers and a completed pedigree for the trait of your choice in the answer box below. You may work alone or with a partner for this exercise.

You will be marked as follows:

Procedure

3. For the pedigree (**9 marks**). Be sure to use all of the proper symbols as outlined on page 612, including Roman and Arabic numerals. Your pedigree must show at least three generations. See the rubric below.

Analysis

1. (**2 marks**)

2. Genotype on the pedigree (**5 marks**)

3. (**2 marks**)

RUBRIC FOR THE PEDIGREE ONLY

	3 marks	2 marks	1 mark
Design	pedigree is clear, fills the screen or page, and shows all the correct connections	pedigree is clear but undersized, or a few connections are misplaced	pedigree is too small or unclear
Accuracy	pedigree shows use of proper symbols, shading, and numerals	pedigree shows only minor mistakes with labelling or symbols	pedigree does not show proper use of symbols, or fails to label with numerals and shading
Depth	pedigree shows three generations	pedigree only shows two generations	pedigree is not given

Unit 1: Introduction to the Course			
Lesson 1: Welcome to the Course	Lesson 2: The Course Objectives	Lesson 3: The Course Structure	Lesson 4: The Course Assessment
Lesson 5: The Course Materials	Lesson 6: The Course Resources	Lesson 7: The Course Support	Lesson 8: The Course Conclusion
Lesson 9: The Course Summary	Lesson 10: The Course Evaluation	Lesson 11: The Course Feedback	Lesson 12: The Course Final

MODULE 1: LESSON 1: ASSIGNMENT

The purpose of this assignment is to introduce you to the course and to help you understand the course objectives and structure.

Objectives of the Assignment

1. Understand the Course Objectives

The first objective of this assignment is to help you understand the course objectives. You should be able to identify the main goals of the course and explain how they relate to the course content.

2. Understand the Course Structure

Introduction

The second objective of this assignment is to help you understand the course structure. You should be able to identify the main components of the course and explain how they relate to the course content.

Assignment

1. Introduction

2. Understanding the Course Objectives

3. Conclusion